

Virginia Space Grant Consortium (VSGC)
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Old Dominion University Research Foundation
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PROGRAM DESCRIPTION

The National Space Grant College and Fellowship Program consists of 52 state-based, university-led Space Grant Consortia in each of the 50 states plus the District of Columbia and the Commonwealth of Puerto Rico. Annually, each consortium receives funds to develop and implement student fellowships and scholarships programs; interdisciplinary space-related research infrastructure, education, and public service programs; and cooperative initiatives with industry, research laboratories, and state, local, and other governments. Space Grant operates at the intersection of NASA's interest as implemented by alignment with the Mission Directorates and the state's interests. Although it is primarily a higher education program, Space Grant programs encompass the entire length of the education pipeline, including elementary/secondary and informal education. The Virginia Space Grant Consortium is a Designated Consortium funded at a level of \$845,000 for fiscal year 2010.

PROGRAM GOALS and OBJECTIVES

NASA Education Outcome One

VSGC Goal 1 - Conduct quality scholarship and fellowship programs including a bridge program for freshman and sophomore students, research awards for undergraduate and graduate students, community college STEM scholarships and teacher education STEM scholarships.

1.A: Each academic year, award students in all five categories with scholarships and fellowships. Students will be competitively selected by review panels consisting of representatives from member institutions. Metric: Review panel for each program reports on the process and total number of awards; *Objective met.* **1.B:** Award at least the minimum amount required by NASA in scholarship and fellowships to at least 60 students each academic year. Metric: Total amount awarded to total number of students in the five scholarship/fellowship categories; *Objective exceeded; \$406,885 awarded to 110 students.* **1.C:** Each academic year, provide a percentage of awards to underrepresented minority and female students that is consistent with the diversity target as established by NASA (currently 24.6% minority, 40% female). Metric: Total awards to minority students divided by total awards to all students; *Objective exceeded; 37% of awards provided to underrepresented minority students and 45% of awards to female students.* **1.D:** At least 90% of students receiving research awards will attend and present at the annual VSGC Student Research Conference. Metric: Total number of research awardees presenting at conference divided by total number of research awardees;

Objective exceeded; 100% presented. 1.E: Longitudinally track 100% of all students receiving significant awards to identify their next step in academia or the workforce. Metric: Total number of students longitudinally tracked to next step divided by total awardees; *Objective met, 100% tracked. 1.F:* At least 60% of students receiving significant awards will be employed by NASA, an aerospace contractor, higher education or other educational institutions. Metric: Total number of students employed in these categories divided by total number of awards; *Objective met; 81% are either employed in these categories or pursuing an advanced STEM degree. 1.G:* At least 45% of undergraduate students receiving significant support from VSGC will move on to advanced education in STEM-related disciplines in their next step. Metric: Total number of students in advanced education in these categories divided by total number of awards. *Objective exceeded; 88% of responders not already employed are pursuing advanced STEM degrees. 1.H:* Each academic year, provide paid internships for at least 4 students at NASA Centers or with industry partners. Metric: Number of students placed in internships. *Objective exceeded; 7 students supported for internships.*

VSGC Goal 2 - Offer quality higher education programs including internship programs in partnership with our member institutions and partners.

2.C: Conduct at least one annual higher education project in partnership with Virginia's community colleges. Metric: Number of collaborative projects with community colleges or the System office; *Objective met. 2.D:* Each year, conduct at least two higher education projects in partnership with VSGC member institutions. Metric: Number of collaborative projects with members. *Objective exceeded, with 5 projects conducted.*

VSGC Goal 3 - Promote diversity in all programs and activities by encouraging participation by underrepresented minority and female students and faculty.

3.A: Each year, conduct at least one outreach event in partnership with Hampton University (HBCU) to promote programs and opportunities to students and faculty. Metric: One HU outreach event; *Objective exceeded; three outreach events. 3.B:* Each year, conduct at least one outreach event in partnership with a non-member minority institution to promote programs and opportunities to students and faculty. Metric: One non-member MSI outreach program; *Objective exceeded with Virginia State University and Norfolk State University. 3.C:* Each academic year, provide a percentage of student awards to underrepresented minority and female students that meets or exceeds the diversity target as established by NASA (currently 24.6% for underrepresented minorities and 40% females). Metric: Total awards to minorities divided by total number of awards; *Objective exceeded; 37% of awards provided to underrepresented minority students and 45% of awards to female students. 3.D:* Provide at least one STEM program each year for special needs faculty or students. Metric: Stated target is met; *Objective met. 3.E:* Undertake at least one collaborative program with a non-member minority serving institution each year. Metric: Stated target is met. *Objective met.*

VSGC Goal 4 – Undertake programs that foster research capabilities at our member institutions and serve as a catalyst for linking university researchers to NASA and other opportunities.

4.A: Conduct a New Investigator award program each year targeting tenure track faculty who are within the first five years of their academic career. At least five awards will be given annually and the research will have NASA relevance. Metric: Stated goal is met; *Objective met; 5 awards with strong NASA relevance given.* **4.B:** Disseminate at least 20 research opportunity announcements to statewide networks each year. Metric: Stated goal is met; *Objective exceeded; 50 announcements disseminated.* **4.C:** Facilitate at least five meetings with university researchers and NASA personnel, as appropriate, resulting in at least two collaborative proposals being submitted. Metric: Stated goal met; *Objective met.* **4.D:** Support at least two experiential student research, mission and design programs each year. Metric: Stated goal is met. *Objective met.*

NASA Education Outcome Two

Goal 5 – Provide quality precollege educational opportunities including professional development for precollege and pre-service educators and student-focused programs for students throughout the precollege pipeline.

5.B: VSGC will reach over 100 students by conducting selected student-focused programs and activities promoting participation in STEM and related careers. Metric: Total number of precollege students participating in student-focused programs; *Objective exceeded with 248 students through Space Grant funding.* **5.C:** At least 75% of precollege educators participating in more than two days of professional development will use NASA resources in their classroom following the workshop. Metric: Total number of educators indicating they will use NASA resources in the classroom on a post-event survey divided by total respondents to survey; *Objective exceeded.* **5.D:** At least 60% of precollege educators receiving NASA resources or participating in VSGC-led short duration activities will use NASA resources in their classroom. Metric: Total number of educators indicating they will use NASA resources in the classroom on a post-event survey divided by total respondents to survey; *Objective exceeded.* **5.E:** At least 50% of all precollege students participating in VSGC-sponsored programs will express an interest in STEM careers. Metric: Total number of students indicating they have an interest in a STEM career on a post-event survey divided by total respondents to survey. *Objective exceeded.*

NASA Education Outcome Three

Goal 6 - Conduct Informal Science Education programs in partnership with informal education members and partners.

6.A: Sponsor at least one program each year with the Virginia Air and Space Center or the Science Museum of Virginia. VSGC will consider other appropriate informal science education opportunities as funding and partnerships permit with the goal of providing at least one other activity per year if funding and resources permit. *Objective exceeded; one program with each partner.*

Goal 7 - Serve as an effective steward of Consortium resources and a strong partner for STEM programs.

7.A: Effectively leverage NASA Space Grant resources. Metric: NASA Space Grant funding will be leveraged by at least 3 dollars to 1 NASA Space Grant Dollar as evidenced in Consortium year-end Matching/Contributed Funding Report; *Objective*

exceeded, each dollar of space grant funds matched by \$1.34; leveraged by about \$6 in funding from all sources. 7.B: Network with other Space Grants and Space Grant organizations. Metric: Evidence of networking and program partnerships; *Objective met; significant evidence. 7.C:* Network with NASA Headquarters and NASA Centers for program implementation. Metric: Evidence of networking and program partnerships; *Objective met; significant evidence. 7.D:* Build and sustain effective strategic partnerships, including relationships with state and federal legislators and officials. Metric: Evidence of state and federal support for VSGC programs and documented attendance by these individuals at select activities and events; *Objective met; state funding increased by \$350,000 to a total of \$595,000 demonstrating strong legislative engagement in VSGC programs. Virginia's Secretary of Education, one congressman, Senate staffer, and four state delegates attended VSGC events. VSGC is active in meetings and briefings to keep legislators informed. 7.E:* Number of program partners working with VSGC each year. Metric: At least 30 non-member partners per year. *Objective exceeded with well over 30 non-member partners.*

PROGRAM/PROJECT BENEFIT TO OUTCOME (1, 2, OR 3)

NASA Education Outcome 1 - VSGC awarded over \$440,000 in direct student awards through scholarships, fellowships, and internships to 117 students and significantly exceeded diversity goals. Minnae Chabwera, a 2010-11 VSGC Undergraduate STEM Bridge scholar, is a rising junior physics major at Hampton University. She has been selected to be a LARSS intern for the summer of 2011. Minnae plans on continuing her research by applying for the VSGC Undergraduate Research Scholarship for her senior year and hopes to work for NASA in the future as an astronaut.

Since 2006, 9 VSGC alumni are working for NASA or JPL and 13 are employed in STEM with an aerospace contractor. VSGC actively disseminated higher education and research opportunities to partners including all minority serving institutions in Virginia. VSGC facilitated collaboration among higher education researchers and NASA resulting in a successful proposal to Ralph Steckler-Phase 1.

NASA Education Outcome 2 – VSGC provided three engineering technology-themed STEM Exploratory Saturday programs for 173 middle school grade students and 147 parents. These events were very successful in meeting objectives. Deputy Superintendent of Instruction and Support Services with Poquoson City Public Schools commented: “The students at Poquoson High School who participated in the Exploratory Saturday programs have been well-prepared to select courses based on their experiences. It helped solidify the importance of STEM courses in preparation for post-secondary endeavors. The Exploratory Saturday events have generated interest and excitement among our students. The involvement of parents has also been beneficial. The collaboration of school divisions and industry partners has been wonderful because it would be difficult for our small school division to offer these events by ourselves.”

PROGRAM ACCOMPLISHMENTS

VSGC actively works with its members and many external partners to accomplish Consortium goals. NASA's funding investment is heavily leveraged by external funding from

federal and state agencies and other nongovernmental sources. The external funding enhanced the VSGC's ability to staff and run a wide range of program in concert with NASA goals. *Only projects paid for by NASA Space Grant funding, Consortium funding, or matching funds are included in this report.*

NASA Education Outcome 1

Education Priorities Alignment: VSGC scholarship/fellowship and higher education programs align with many of NASA's educational priorities including authentic, hands-on student experiences in science and engineering disciplines rooted in NASA-related issues, and the incorporation of real-life problem-solving and needs as context for activities. Several student research projects focus on NASA research priorities including traditional aeronautics disciplines and climate change. Supported projects reflect diversity in institutions, faculty and student participants. Existing partnerships with community colleges are strengthened through these projects.

Scholarship/Fellowship/Internships (VSGC Goals/Objectives 1-3)

For the 2011-12 academic year, the VSGC awarded \$406,885 in scholarships and fellowships from NASA Space Grant and State matching funds (\$170,000) to 110 students attending Virginia universities.

- \$205,000 went to 41 students for graduate research fellowships; Additional matching funds of \$280,533 to support graduate research awards were also provided by member institutions.
- \$110,719 went to 16 students for undergraduate research scholarships
- \$10,500 went to 7 community college students majoring in STEM
- \$9,000 went to 9 students majoring in education who plan to teach in STEM
- \$37,000 went to 37 freshman or sophomore students majoring in STEM through the Undergraduate STEM Bridge scholarship program.

During FY10, VSGC held the annual Student Research Conference where research awardees presented their research. In April 2011, the University of Virginia hosted the conference and sponsored the luncheon in honor of the 2010-11 awardees. The event was attended by faculty and NASA and industry representatives.

VSGC also provided \$34,603 in funding to seven students to support internships and travel for summer 2011:

- Space Grant NASA Science Mission Directorate (SMD) internship program through a placement at the Chandra Observatory.
- Student intern support for Dr. Joyce Winterton at NASA Wallops Flight Facility through the OSSI:SOLAR program.
- Student internship at the Johns Hopkins Applied Physics Laboratory.
- Student internship at the Aeronautics Academy at NASA Langley
- Student internship at the Aeronautics Academy at NASA Glenn.
- Student internship at NASA Goddard through the OSSI:SOLAR program.
- Travel support for one Hampton University (HBCU) student (also current VSGC STEM Bridge Scholar) to attend the Space Shuttle Symposium in June 2011.

Higher Education (VSGC Goal/Objectives 2)

- VSGC established a competitive proposal and award process for VSGC Innovative Projects during FY10. VSGC invited proposals in three areas of interest:
 1. Development of new higher education STEM courses with NASA relevance.
 2. Support for Student Flight projects.
 3. Professional Development programs for Middle School Teachers.

Of the six VSGC-supported projects through this process, two were in Higher Education:

- Hampton University (HBCU) and Virginia Tech, “Development of an Innovative Combined Sensor”: Developed an innovative combined star tracker and nitric oxide sensor to be flown on the 2012 RockSat-C or RockSat-X sounding rocket flight. Project involved 3 undergraduate or recent graduates during the 2011 summer term at Virginia Tech. This project serves as proof of concept, enhances the student instrument design and development infrastructure, will generate results that will be used in future proposals for NASA Space and Earth Sciences, and deepens the collaboration between Virginia Tech and Hampton University (HBCU).
- University of Virginia, Education and Outreach for HY-V Program: Hy-V is a research and educational activity aimed at examining the influence of ground test facilities on scramjet performance and has been funded by VSGC and other partners. Through this project, faculty and students will further develop a full scale model of the Hy-V payload and will create and present public displays for dissemination of research results.
- It is anticipated that forum-style meetings held this year with administrators and faculty from STEM disciplines at Virginia State University and Norfolk State University (both HBCU’s) to discuss collaborative projects will hopefully result in new collaborations and jointly funded proposals.
- VSGC supported 15 female students to attend Old Dominion University’s Engineering Early Advantage Program which targets females entering into the Engineering program the summer before their freshman year. These students complete engineering-related projects and meet faculty to become familiar the engineering discipline. This program has led to improved retention of majority and minority females in STEM. In summer 2011, VSGC will support 15 additional students.
- VSGC, in partnership with Colorado Space Grant Consortium offered a RockOn! workshop in June 2010. RockOn! is a workshop for faculty and students where participant teams learn to build a small sounding rocket payload and launch it on a sounding rocket at NASA’s Wallops Flight Facility. VSGC assembled the payload kits. The hardware in the kit will be able to be used on future custom RockSat payloads and possibly CubeSat flights. Full impact data will be reported by the Colorado Space Grant Consortium. VSGC also sponsored three students and one faculty for RockSat. VSGC will continue to support the RockOn! workshop at this level in summer 2011.
- VSGC supported the cash prizes for the three GIS poster awards given during Virginia Tech’s annual Geospatial Symposium.

- VSGC supported a collaborative student-led cubesat project between Virginia Tech and the Puerto Rico Space Grant, including several minority serving institutions in Puerto Rico. VSGC supported three students from Virginia to participate.
- VSGC is sponsoring a faculty fellowship for a faculty member at Norfolk State University to conduct research at NASA Langley.
- No member university faculty requested faculty professional development support budgeted for FY10. These funds were reallocated to other VSGC educational programs.

Research Infrastructure (VSGC Goal 4)

Education Priorities Alignment: VSGC's research infrastructure projects support NASA's needs. In support of a NASA Space Grant area of emphasis, VSGC provided the New Investigator Program to strengthen Virginia's research infrastructure by providing startup funding to early career faculty from member institutions conducting research that is directly aligned with NASA's mission. Five faculty members from VSGC-member institutions received an award of \$10,000 each for their research project related to NASA missions and activities.

- Dr. Chris Brill, Old Dominion University, Department of Psychology. Dr. Brill's research included an interdisciplinary team to investigate psycho-physiological responses associated with motion sickness using real and visually-induced (apparent) motion.
- Dr. Christopher Moen, Virginia Tech, Department of Aerospace and Ocean Engineering. Dr. Moen's research sought to improve aircraft performance through fundamental study of thin-walled composite cylinders on "next generation" fuselage and blended-wing aircraft.
- Dr. Kim Hazelwood, University of Virginia, Computer Science. Her proposal focused on holistic approaches for improving computer systems design, as an enabling technology for space missions and other scientific advances.
- Dr. Matthias Leu, College of William and Mary, Department of Biology. Dr. Leu's research studied the spatial model of human actions on the Eastern United States relative to climate change and changes in the nutrient cycle of exotic plant and vertebrate species.
- Dr. Seth Aubin, College of William and Mary, Department of Physics. His research focused on an atomic clock that eventually could be applied to deep space navigation using fermion atoms to ensure the stability and accuracy.

NASA Education Outcome 2

Precollege Programs (VSGC Goal 5)

Education Priorities Alignment: VSGC's suite of precollege programs includes projects targeting both students and teachers and aligns with NASA's areas of emphasis. Several projects engage middle school teachers in hands-on curriculum enhancement capabilities through exposure to NASA scientific and technical expertise and support teachers' ability to provide authentic, hands-on middle school student experiences in STEM. Follow-up surveys were conducted of all participating teachers. One space grant-funded project provided

summer opportunities for secondary students on college campuses with the objective of increased enrollment in STEM disciplines and interest in STEM careers.

- VSGC coordinated three engineering technology-themed STEM Exploratory Saturday programs for 173 middle school grade students and 147 parents through the Governor's Academy for Innovation, Technology, and Engineering (GAITE) in partnership with Thomas Nelson Community College (TNCC), NASA Langley Research Center, Northrop Grumman, and Canon Virginia. TNCC hosted a Saturday and provided a college campus experience for the students. VSGC also coordinated a teacher professional development workshop for 23 high school teachers of courses in the GAITE pathways to learn how to teach integrative STEM education. The 2010 GAITE activities were funded through state funds with VSGC contributions of staff time and resources.
- VSGC trained 20 teachers through Offering Virginia Educators Resources in Spatial Practices Across the Curriculum for Excellence (OVERspace) which is a program that teaches teachers how to implement GPS/GIS in the classroom.
- VSGC supported the keynote speaker at the Virginia Association of Science Teachers (VAST) 2010 Conference and also provided an exhibit to market VSGC programs.
- VSGC is supporting four visually impaired students to attend the National Federation of the Blind Youth Slam 2011 event to engage, inspire, and encourage the next generation of blind youth to learn about and consider careers in STEM.
- VSGC supported the MathScience Innovation Center to pilot a graduate course for 18 middle school teachers. The *Mathematics Fellows* project provided a 3-credit graduate course for 18 middle school teachers in central Virginia. The course increased teacher's number sense and understanding of effective pedagogy, and used real-world examples to strengthen integration of NASA resources and requirements related to classroom implementation. Follow-up activities in the fall included peer mentoring, distance education course, and a reflection journal.
- VSGC supported the cash prizes for the three winners of the Virginia State Science Fair in aerospace categories.
- VASC provided support to Virginia Air and Space Center for teacher workshops in global climate change. Sixty-eight teachers investigated the science of climate change by collecting real-time data using GPS and a variety of probes and sensors, and then participated in the collaboration process through analysis of previously collected data through sources such as MyNASAData and GLOBE.
- As part of its efforts to build aerospace programs in rural southwest Virginia, VSGC supported a high school student rocketry project led by Wise County Career Technical Center. The project, *Ad Astra - To the Stars*, provided model rocket kits, a workshop and mentoring to support student development of a rocket for the Team America rocketry competition. Thirty students from six high schools participated.
- VSGC also supported 4 precollege projects through the VSGC Innovative Projects competitive proposal process described in detail in the Higher Education section.
 - Science Museum of Virginia, "Could a Comet Land in My Living Room": One-day middle school teacher workshop for 36 teachers demonstrates how resources provided by the Museum provide dynamic and engaging experiences that bring Virginia Standards of Learning to life for middle school aged students and teachers. The workshop provides inquiry-based classroom activities that

reinforce these lessons, and support future field trip visits to view the exhibit, film, and science on a sphere demonstration.

- MathScience Innovation Center, “Mathematics Fellows Graduate Course”: This project will allow the Center to build on the VSGC-funded pilot workshop described above and offer a 3-credit graduate course for 18 additional middle school teachers from central Virginia in summer 2011.
- Hampton University, Teacher Workshop to Broaden Participation in Space Science: Two-day workshop to train two local middle-school teachers of mathematics on how to use an existing educational game in space science. Two new computer games will then be developed by HU undergraduate students integrating feedback from the teachers prior to piloting in area classrooms.
- Virginia Department of Education, “Technology and Engineering in STEM Education”: Fifteen middle school teachers are attending up to 3 days of professional development on the use of NASA materials and engineering by design. The lessons include STEM standards that reinforce and complement each other to provide relevant contextual instruction for middle school students.

NASA Education Outcome 3

Informal Education Programs (VSGC Goal 6)

- VSGC co-sponsored and exhibited at the annual Yuri’s Night event hosted by the VASC which is an informal education event that celebrates humanity’s achievements in space. The event was attended by 300 people.

PROGRAM CONTRIBUTIONS TO PART MEASURES

- **Student data and Longitudinal Tracking**: Total awards = 140; Fellowship/Scholarship/Internships = 117, Higher Education/Research Infrastructure = 23; 35% of the total awards represent underrepresented minority funding and 45% of the total awards were to female students. Since 2006, 34 students have graduated and are pursuing an advanced STEM degree; 12 students have accepted STEM positions in the aerospace industry; 13 students are employed in STEM in a non-aerospace industry; 9 students are employed by NASA; 16 are employed in a STEM academic field in higher education, and; 3 students are employed in K12 STEM.
- **Course Development**: One new graduate course targeting the STEM skills needed by NASA was developed with NASA Space Grant funding by the MathScience Innovation Center. Virginia Tech will also develop one course as a result of a VSGC Innovative Project funded.
- **Matching Funds**: VSGC matched NASA Space Grant funding with a ratio of \$1.34 for each Space Grant dollar.
- **Minority Serving Institution Collaborations**: VSGC presented scholarship/fellowship and research opportunities to faculty and students at Hampton University (HU) during three separate visits to the campus. HU hosted a lunch and learn event for undergraduate and graduate students majoring in STEM to learn about scholarship/fellowship opportunities. VSGC was also invited to present at two Department Chair meetings in the School of Science at HU. HU received one precollege and one higher education project through the VSGC Innovative Projects

process. VSGC is sponsoring a faculty fellowship for a faculty member at Norfolk State University to conduct research at NASA Langley. It is anticipated that University-wide, forum-style meetings with faculty from Virginia State University and Norfolk State University held this year will result in collaborative proposals and projects. VSGC supported a collaborative student-led project between Virginia Tech and the Puerto Rico Space Grant, including several minority serving institutions in Puerto Rico. Fifty research opportunities were disseminated to minority serving institutions during FY10.

IMPROVEMENTS MADE IN THE PAST YEAR

- VSGC increased staff during the FY10 year. The Consortium is paying for one additional educational program specialist.
- FY10 was an excellent year for VSGC externally funded programs with 9 proposals awarded out of 20 submitted with 6 proposals still pending. Total amount awarded to VSGC was \$2.5 million with \$4.4 million pending in external funding (represents total amount awarded for several multi-year projects).
- VSGC awarded a record number of scholarships and fellowships to students including a 22% increase in number of awards and a 24% increase in amount of funding awarded as compared to previous high numbers (FY09).
- The Consortium's Host Institution, ODU, provided additional office space of 540 square feet.
- VSGC continued to enhance state government engagement in Consortium programs and secured an additional \$350,000 in state support in addition to the \$245,000 already provided for VSGC programs.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

VSGC members and partners play active roles in project development and implementation. In some cases, VSGC provides funding directly to member institutions for projects and the member institution has the lead. In other projects, VSGC staff may take the lead for project coordination working closely with partners for project execution. For competitive opportunities, the VSGC uses a panel of member and sometimes external representatives to make selections of which students or faculty to fund.

VSGC Affiliate members include: College of William and Mary, Hampton University, Old Dominion University, University of Virginia, Virginia Polytechnic Institute and State University, NASA Langley Research Center, NASA Goddard Space Flight Center's Wallops Flight Facility, Science Museum of Virginia, State Council of High Education for Virginia, Virginia Community College System, Virginia Department of Education, MathScience Innovation Center, Virginia Air and Space Center, and Virginia's Center for Innovative Technology.

VSGC scholarships and fellowships are open only to students attending affiliate institutions, including all 23 community colleges. Internship support is available to students attending any Virginia higher education institution. VSGC partners not only with affiliates but with many other organizations and institutions including industry and NASA Centers on projects. NASA

Langley, NASA Wallops were key partners in several VSGC projects. Together with Johnson Space Center, they were also key partners in several of VSGC's external proposals won during FY10.